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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/767,039	01/29/2004	Toshiharu Furukawa	ROC920030272US1	4826
30206	7590	02/09/2006	EXAMINER	
IBM CORPORATION ROCHESTER IP LAW DEPT. 917 3605 HIGHWAY 52 NORTH ROCHESTER, MN 55901-7829			CAO, PHAT X	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 02/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/767,039

Applicant(s)

FURUKAWA ET AL.

Examiner

Phat X. Cao

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-5, 7-15 and 42-45 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-15 and 42-45 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>9/19/05</u> . | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

1. The cancellation of claims 6 and 16-41 in Paper filed on 11/21/05 is acknowledged.

#### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

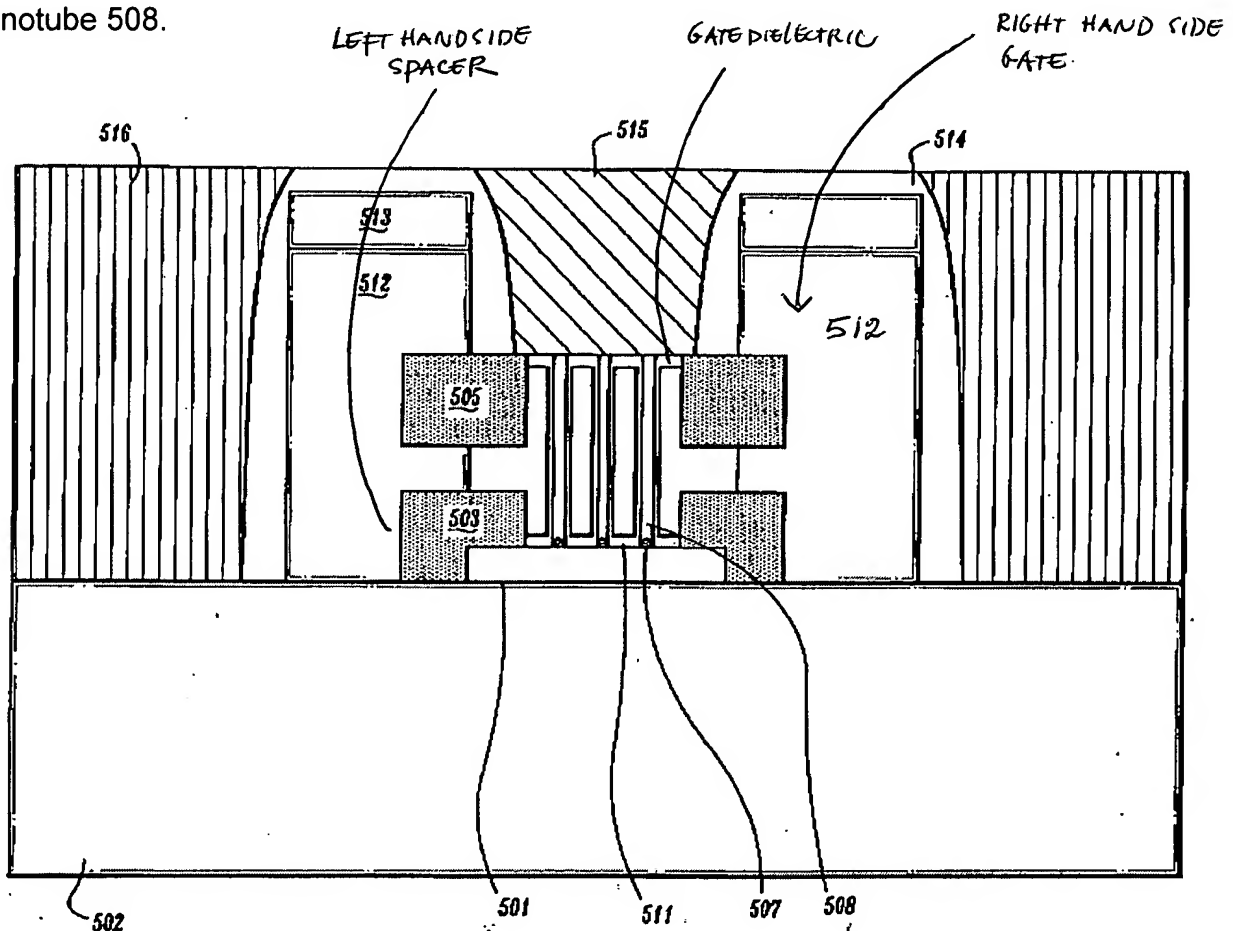
(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-5, 8-11, 12-15, and 42-45 are rejected under 35 U.S.C. 102(e) as being anticipated by Appenzeller et al (US. 2005/0056826).

Regarding claims 1, 5 and 42, Appenzeller (Fig. 5n) discloses a vertical Semiconductor device structure, comprising: a substrate 502 defining a substantially horizontal plane; a gate electrode 512 on a right hand side (par. [0040], lines 19-20) projecting vertically from the substrate 502 and including a vertical sidewall; a spacer 503 on a left hand side of a dielectric material (par. [0038], lines 6-7) flanking the vertical sidewall and spaced horizontally from the vertical sidewall of the right hand side gate electrode 512 to define a vertical passage; a carbon semiconductor nanotube 508 (par. [0038], lines 1-3) positioned in the vertical passage and extending between opposite first and second ends with a substantially vertical orientation; a gate dielectric 511 (par. [0040], lines 13-14) disposed on the vertical sidewall between the

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semiconductor nanotube 508 and the right hand side gate electrode 512; a source/drain 501 electrically coupled with the first end of the semiconductor nanotube 508; and a source/drain 515 electrically coupled with the second end of the semiconductor nanotube 508.

**FIG. 5n**

Regarding claims 2-3 and 9, Appenzeller (Fig. 5n) further discloses that the source/drain 501 is composed of a catalyst material (par. [0038], lines 1-6) effective for synthesizing the semiconductor nanotube 508, and the source/drain 501 is positioned on the substrate 502 in vertical alignment with the passage.

It is noted that the method of depositing the conductive layers selected from chemical vapor deposition, is an intermediate process step that does not affect the structure of the final device. Therefore, the process limitations (formed by a chemical vapor deposition) recited in a "product by process" claim would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claim 8, Appenzeller (Fig. 5n) further discloses that the passage has a rectangular cross-sectional profile when viewed in a vertical direction.

Regarding claims 4, 10-11 and 44, Appenzeller (Fig. 5n) further discloses that the top portion of the spacer is vertically spaced relative to the substrate 502 to define a gap, the gap being filled by a bottom portion of the spacer 503.

It is noted that the method of depositing the conductive layers selected from chemical vapor deposition or the gap being filled by an insulating material after..., is an intermediate process step that does not affect the structure of the final device. Therefore, the process limitations recited in a "product by process" claim would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claims 12-15 and 45, Appenzeller (Fig. 5n) further discloses a plurality of semiconductor nanotubes 508 positioned horizontally between the right hand side gate electrode 512 and the left hand side spacer 503, each of the plurality of nanotubes 508 extending vertically in the passage and having a first end electrically coupled with the source/drain 501 and the second end electrically coupled with the source/drain 515,

and an insulating material 511 filling space within the passage not occupied by the plurality of nanotubes 508.

Regarding claim 43-44, Appenzeller (Fig. 5n) also discloses that the top portion of spacer 503 is separated from the substrate 502 by a gap and the spacer 503 is separated from the sidewall by a passage, the nanotube 508 is positioned in the passage, and an insulating material comprising the spacer portion 503 (bottom portion) filling the gap and an insulating layer 511 filling portions of the passage unfilled by the nanotube 508.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Appenzeller et al in view of Dubin et al (US. 2005/0167755).

Appenzeller does not disclose that the nanotube 508 has a vertical dimension greater than or equal to a vertical height of the gate electrode 512.

However, Dubin teaches that the vertical heights of the nanotube and the gate electrode can be adjusted. Specifically, Dubin teaches that the vertical height of the nanotube can be either greater than the vertical height of the gate electrode (Fig. 5F) or equal to the vertical height of the gate electrode (Fig. 6F). Accordingly, it would have been obvious to modify the device of Appenzeller by adjusting the height of the gate

electrode because the height of the gate electrode can be varied depending upon the desired conductivity for the gate electrode.

***Response to Arguments***

6. Applicant's arguments with respect to amended claims have been considered but are moot in view of the new ground(s) of rejection. Because of the new issues presented in the amended claims, the new reference is cited in the new ground of rejection.

***Conclusion***

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is 571-272-1703.

The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PC  
February 3, 2006

  
PHAT X. CAO  
PRIMARY EXAMINER